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## Supplemental Material

### Relationships of Perfluorooctanoate and Perfluorooctane Sulfonate Serum

### Concentrations Between Child-Mother Pairs in a Population with Perfluorooctanoate

### Exposure from Drinking Water

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Supplemental Material, Table 1. Classification of matched child-mother pairs, Mid-Ohio Valley, 2005-2006

| Classification | Criteria                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perfect        | Child's month/year of birth and gender match in "child and mother files" and mother's first/last name is recorded as the parent in the "guardian file".                                                                                                                                                                                                                                          |
| Excellent      | Child's month/year of birth, gender and last names match in "child and mother files" but the mother cannot be confirmed in the "guardian file".                                                                                                                                                                                                                                                  |
| Good           | Child's month/year of birth and gender match in "child and mother files" but last names do not match and the mother cannot be confirmed in the "guardian file" OR last names or address and gender match in "child and mother files" but child's month/year of birth do not match in the "child and mother files" but mother's first/last name is recorded as the parent in the "guardian file". |
| Probable       | Last name or address and gender match in "child and mother files" but child's month/year of birth do not match in the "child and mother files" and the mother cannot be confirmed in the "guardian file" OR mother's first/last name is recorded as the parent in the "guardian file" but child's month/year of birth and last names or address do not match in the "child and mother files".    |

Supplemental Material, Table 2. Detail of frequency of successful child-mother matches by age and type of match, Mid-Ohio Valley, 2005-2006

| Child age | Total (Children) | Matched | % of matched children | Type of match <sup>a</sup> |           |      |          |
|-----------|------------------|---------|-----------------------|----------------------------|-----------|------|----------|
|           |                  |         |                       | perfect                    | excellent | good | probable |
| 1         | 41               | 31      | 75.61                 | 25                         | 2         | 5    | 0        |
| 2         | 195              | 162     | 83.08                 | 136                        | 13        | 13   | 0        |
| 3         | 274              | 225     | 82.12                 | 180                        | 20        | 22   | 3        |
| 4         | 329              | 267     | 81.16                 | 213                        | 27        | 25   | 2        |
| 5         | 326              | 266     | 81.60                 | 214                        | 27        | 24   | 1        |
| 6         | 362              | 284     | 78.45                 | 242                        | 22        | 19   | 1        |
| 7         | 393              | 317     | 80.66                 | 252                        | 39        | 24   | 2        |
| 8         | 417              | 321     | 76.98                 | 265                        | 31        | 23   | 2        |
| 9         | 464              | 368     | 79.31                 | 308                        | 27        | 31   | 2        |
| 10        | 507              | 389     | 76.73                 | 304                        | 38        | 45   | 2        |
| 11        | 482              | 295     | 61.20                 | 180                        | 25        | 78   | 12       |
| 12        | 522              | 386     | 73.95                 | 314                        | 38        | 32   | 2        |
| 13        | 566              | 424     | 74.91                 | 324                        | 55        | 41   | 4        |
| 14        | 608              | 458     | 75.33                 | 381                        | 38        | 33   | 6        |
| 15        | 676              | 491     | 72.63                 | 373                        | 74        | 41   | 3        |
| 16        | 684              | 444     | 64.91                 | 348                        | 53        | 39   | 4        |
| 17        | 656              | 439     | 66.92                 | 332                        | 67        | 37   | 3        |
| 18        | 685              | 374     | 54.60                 | 42                         | 267       | 54   | 11       |
| 19        | 705              | 359     | 50.92                 | 8                          | 285       | 54   | 12       |
| Total     | 8,893            | 6,301   | 70.85                 | 4,441                      | 1,148     | 640  | 72       |

<sup>a</sup>Defined in Supplemental Material, Table 1

Supplemental Material, Table 3. Overall Spearman correlation between child and mother PFAAs by type of match

| Variable | Match type <sup>a</sup> | <i>n</i> | rho  |
|----------|-------------------------|----------|------|
| PFOA     | all                     | 5,572    | 0.81 |
|          | perfect                 | 3,872    | 0.82 |
|          | excellent               | 1,071    | 0.80 |
|          | good                    | 546      | 0.78 |
|          | probable                | 63       | 0.66 |
| PFOS     | all                     | 5,572    | 0.27 |
|          | perfect                 | 3,872    | 0.27 |
|          | excellent               | 1,071    | 0.27 |
|          | good                    | 546      | 0.31 |
|          | probable                | 63       | 0.43 |

<sup>a</sup>Defined in Supplemental Material, Table 1

PFAA, perfluoroalkyl acid; PFOA, perfluorooctanoate; PFOS, perfluorooctane sulfonate.

Supplemental Material, Table 4. Results of regression analyses of child's serum PFOA and PFOS concentration (y) on mother's (x)

| Contaminant | Child's age | Constraint | All                |                   |                | Stable <sup>a</sup> |                   |                |
|-------------|-------------|------------|--------------------|-------------------|----------------|---------------------|-------------------|----------------|
|             |             |            | Intercept (95% CI) | Slope (95% CI)    | R <sup>2</sup> | Intercept (95% CI)  | Slope (95% CI)    | R <sup>2</sup> |
| PFOA        | All (1-19)  | No         | 0.91 (0.86, 0.96)  | 0.76 (0.75, 0.79) | 0.695          | 0.78 (0.70, 0.87)   | 0.81 (0.79, 0.83) | 0.736          |
|             |             | Yes        | 0.14 (0.12, 0.16)  | 1                 |                | 0.10 (0.07, 0.13)   | 1                 |                |
|             | ≤ 5         | No         | 0.89 (0.72, 1.06)  | 0.84 (0.79, 0.89) | 0.701          | 0.64 (0.40, 0.88)   | 0.91 (0.84, 0.97) | 0.741          |
|             |             | Yes        | 0.36 (0.30, 0.43)  | 1                 |                | 0.32 (0.24, 0.39)   | 1                 |                |
|             | 6 -10       | No         | 0.93 (0.83, 1.02)  | 0.8 (0.77, 0.83)  | 0.724          | 0.88 (0.73, 1.03)   | 0.82 (0.78, 0.86) | 0.744          |
|             |             | Yes        | 0.27 (0.23, 0.30)  | 1                 |                | 0.23 (0.18, 0.29)   | 1                 |                |
|             | > 10        | No         | 0.90 (0.84, 0.96)  | 0.74 (0.72, 0.76) | 0.696          | 0.71 (0.60, 0.83)   | 0.80 (0.77, 0.83) | 0.753          |
|             |             | Yes        | 0.04 (0.02, 0.07)  | 1                 |                | -0.04 (-0.08, 0.01) | 1                 |                |
| PFOS        | All (1-19)  | No         | 2.31 (2.25, 2.37)  | 0.25 (0.22, 0.27) | 0.088          | 2.28 (2.17, 2.39)   | 0.26 (0.22, 0.29) | 0.085          |
|             |             | Yes        | 0.36 (0.33, 0.38)  | 1                 |                | 0.32 (0.29, 0.35)   | 1                 |                |
|             | ≤ 5         | No         | 2.21 (2.02, 2.39)  | 0.23 (0.16, 0.30) | 0.073          | 2.15 (1.88, 2.41)   | 0.25 (0.15, 0.35) | 0.082          |
|             |             | Yes        | 0.29 (0.22, 0.36)  | 1                 |                | 0.23 (0.14, 0.33)   | 1                 |                |
|             | 6 -10       | No         | 2.51 (2.39, 2.63)  | 0.22 (0.17, 0.26) | 0.064          | 2.41 (2.18, 2.63)   | 0.25 (0.17, 0.34) | 0.063          |
|             |             | Yes        | 0.49 (0.45, 0.53)  | 1                 |                | 0.46 (0.40, 0.52)   | 1                 |                |
|             | > 10        | No         | 2.25 (2.18, 2.33)  | 0.26 (0.23, 0.28) | 0.101          | 2.25 (2.12, 2.39)   | 0.26 (0.21, 0.30) | 0.104          |
|             |             | Yes        | 0.31 (0.28, 0.33)  | 1                 |                | 0.27 (0.22, 0.31)   | 1                 |                |

<sup>a</sup>Stable: the mother and child remained in the same water district (the six contaminated districts) from the child birth up to the survey. PFAA, perfluoroalkyl acid; PFOA, perfluorooctanoate; PFOS, perfluorooctane sulfonate.

Two regression analyses of logged child's on mother's PFOA and PFOS are shown for each age group as a) an unconstrained linear regression and b) a regression constraining the slope to be equal to one.

The unconstrained regression consistently shows slopes less than one. This pattern is, however, expected even where true slopes are equal to one if the x as well as the y variable is subject to error, such as anticipated here due to short-term within-person variation (Armstrong. 1998). This reasoning, together with advantages in simplifying the relationship, motivates the regression constrained with slope constrained to equal one, which is equivalent to estimating the ratio of geometric means. ( $\exp(\text{intercept}) = \text{GM}(\text{child})/\text{GM}(\text{mother})$ ).

Supplemental Material, Table 5. Geometric mean of mother and child PFOA concentrations and their ratio and Spearman correlation coefficients by age of child, Mid-Ohio Valley, 2005-2006

| Child age (years) | <i>n</i> | GM PFOA (ng/mL) |       | child: mother GM ratio | rho  |
|-------------------|----------|-----------------|-------|------------------------|------|
|                   |          | mother          | child |                        |      |
| 2                 | 59       | 23.17           | 33.71 | 1.45                   | 0.74 |
| 3                 | 117      | 28.55           | 42.75 | 1.50                   | 0.86 |
| 4                 | 147      | 25.12           | 38.00 | 1.51                   | 0.82 |
| 5                 | 162      | 27.94           | 37.27 | 1.33                   | 0.81 |
| 6                 | 194      | 28.44           | 39.13 | 1.38                   | 0.83 |
| 7                 | 248      | 26.13           | 37.14 | 1.42                   | 0.87 |
| 8                 | 259      | 26.64           | 34.25 | 1.29                   | 0.84 |
| 9                 | 313      | 28.00           | 35.99 | 1.29                   | 0.86 |
| 10                | 320      | 27.23           | 33.67 | 1.24                   | 0.83 |
| 11                | 194      | 31.05           | 34.44 | 1.11                   | 0.84 |
| 12                | 340      | 29.60           | 33.16 | 1.12                   | 0.85 |
| 13                | 372      | 26.00           | 26.79 | 1.03                   | 0.82 |
| 14                | 406      | 24.66           | 25.44 | 1.03                   | 0.84 |
| 15                | 435      | 26.09           | 27.97 | 1.07                   | 0.83 |
| 16                | 390      | 28.67           | 28.57 | 1.00                   | 0.81 |
| 17                | 391      | 26.51           | 26.94 | 1.02                   | 0.81 |
| 18                | 306      | 28.45           | 30.60 | 1.08                   | 0.78 |
| 19                | 290      | 27.85           | 27.85 | 1.00                   | 0.76 |

GM, geometric mean ; PFOA, perfluorooctanoate.

Supplemental Material, Table 6. Geometric mean of mother and child PFOS concentrations and their ratio and Spearman correlation coefficient by age of child, Mid-Ohio Valley, 2005-2006

| Child age (years) | <i>n</i> | GM PFOS (ng/mL) |       | child: mother GM ratio | rho  |
|-------------------|----------|-----------------|-------|------------------------|------|
|                   |          | mother          | child |                        |      |
| 2                 | 59       | 11.92           | 11.73 | 0.98                   | 0.30 |
| 3                 | 117      | 11.76           | 15.88 | 1.35                   | 0.16 |
| 4                 | 147      | 12.16           | 15.68 | 1.29                   | 0.26 |
| 5                 | 162      | 11.96           | 18.49 | 1.55                   | 0.36 |
| 6                 | 194      | 12.86           | 19.43 | 1.51                   | 0.26 |
| 7                 | 248      | 12.90           | 20.55 | 1.59                   | 0.13 |
| 8                 | 259      | 12.96           | 22.27 | 1.72                   | 0.28 |
| 9                 | 313      | 13.63           | 23.45 | 1.72                   | 0.27 |
| 10                | 320      | 13.67           | 21.66 | 1.58                   | 0.28 |
| 11                | 194      | 13.38           | 20.72 | 1.55                   | 0.19 |
| 12                | 340      | 13.69           | 19.61 | 1.43                   | 0.33 |
| 13                | 372      | 13.95           | 18.58 | 1.33                   | 0.36 |
| 14                | 406      | 12.92           | 17.66 | 1.37                   | 0.23 |
| 15                | 435      | 13.86           | 18.52 | 1.34                   | 0.25 |
| 16                | 390      | 14.28           | 19.37 | 1.36                   | 0.24 |
| 17                | 391      | 13.48           | 18.44 | 1.37                   | 0.31 |
| 18                | 306      | 14.23           | 19.00 | 1.34                   | 0.37 |
| 19                | 290      | 13.75           | 17.49 | 1.27                   | 0.17 |

GM, geometric mean; PFOS, perfluorooctane sulfonate



Supplemental Material, Table 7. Geometric means and ranges (ng/mL) of maternal PFOA for the matched child-mother pairs in three exposure groups, Mid-Ohio Valley, 2005-2006

| Exposure <sup>a</sup> | WD    | N   | GM    | P 10 <sup>th</sup> , P 90 <sup>th</sup> |
|-----------------------|-------|-----|-------|-----------------------------------------|
| High                  | 3     | 416 | 210.2 | 75.6, 601.7                             |
| Medium                | 1,2,4 | 875 | 33.7  | 14.2, 89.8                              |
| Low                   | 5,6   | 472 | 10.3  | 4.9, 22.9                               |

GM, geometric mean; P, percentile; PFOA, perfluorooctanoate; WD, water district;

<sup>a</sup> the mother and child remained in the same water district (the six contaminated districts) from the child birth up to the survey

## **References**

Armstrong BG. 1998. Effect of measurement error on epidemiological studies of environmental and occupational exposures. *Occup Environ Med* 55: 651-656.